

WHAT IS CLAIMED IS:

1. A method comprising the steps of:
 - a) functionalizing CNTs to form functionalized CNTs;
 - b) mixing the functionalized CNTs with an elastomeric precursor to form a mixture; and
 - c) curing the mixture to form a CNT-elastomer composite.
2. The method of claim 1, wherein the functionalized CNTs are functionalized on their sidewalls.
3. The method of claim 1, wherein the CNTs are single-wall carbon nanotubes.
4. The method of claim 1, wherein the step of functionalizing comprises a reaction between CNTs and at least one diazonium species.
5. The method of claim 4, wherein the reaction between the CNTs and the at least one diazonium species is a solvent-free process.
6. The method of claim 4, wherein the CNTs are dispersed as individuals prior to reacting them with the diazonium species.
7. The method of claim 6, wherein the CNTs are dispersed as individuals with the aid of a surfactant.
8. The method of claim 6, wherein the CNTs are dispersed as individuals in an intercalating acid medium.

9. The method of claim 8, wherein the intercalating acid medium is oleum.
10. The method of claim 1, wherein the step of mixing is carried out in a solvent.
11. The method of claim 10, wherein the solvent is removed after mixing via vacuum drying.
12. The method of claim 1, wherein the step of mixing is carried out in a blending apparatus.
13. The method of claim 1, wherein the step of mixing is carried out for a duration of from about 1 second to about 3 days.
14. The method of claim 1, wherein the step of mixing is carried out at a temperature of from about 20°C to about 400°C.
15. The method of claim 1, wherein the amount of functionalized CNTs mixed with the elastomeric precursor is from about 0.01 weight percent to about 30 weight percent of the weight of the resulting composite.
16. The method of claim 1, wherein the elastomeric precursor is selected from the group consisting of poly(dimethylsiloxane), polyisoprene, polybutadiene, polyisobutylene, halogenated polyisoprene, halogenated polybutadiene, halogenated polyisobutylene, low-temperature epoxy, nitrile polymers such as polyacrylonitrile, fluoropolymers, EPDM terpolymers, and combinations thereof.
17. The method of claim 1, wherein the step of curing effects a crosslinking within the composite matrix.

18. The method of claim 1, wherein the step of curing comprises a curing process selected from the group consisting of thermal curing, radiative curing, chemical curing, and combinations thereof.
19. The method of claim 1, wherein the step of curing involves a curing agent.
20. The method of claim 1, wherein the step of curing involves a curing catalyst.
21. The method of claim 1, wherein the step of curing involves a curing temperature of from about 80°C to about 200°C.
22. The method of claim 1, wherein the step of curing involves a curing pressure of from about 1 Torr to about 760 Torr.
23. The method of claim 1, wherein the step of curing is carried out in an inert atmosphere.
24. The method of claim 1 further comprising a step of reacting the functionalized CNTs with the elastomer so as to covalently integrate the CNTs into the elastomeric matrix.
25. A method comprising the steps of:
 - a) surfactant-wrapping CNTs to form surfactant-wrapped CNTs;
 - b) mixing the surfactant-wrapped CNTs with an elastomeric precursor to form a mixture; and
 - c) curing the mixture to form a CNT-elastomer composite.

26. The method of claim 25, wherein the CNTs are single-wall carbon nanotubes.
27. The method of claim 25, wherein the step of mixing is carried out in a solvent.
28. The method of claim 27, wherein the solvent is removed after mixing via vacuum drying.
29. The method of claim 25, wherein the step of mixing is carried out in a blending apparatus.
30. The method of claim 25, wherein the step of mixing is carried out for a duration of from about 1 second to about 3 days.
31. The method of claim 25, wherein the step of mixing is carried out at a temperature of from about 20°C to about 400°C.
32. The method of claim 25, wherein the amount of surfactant-wrapped CNTs mixed with the elastomeric precursor is from about 0.001 weight percent to about 20 weight percent of the total weight of the resulting composite.
33. The method of claim 25, wherein the elastomeric precursor is selected from the group consisting of poly(dimethylsiloxane), polyisoprene, polybutadiene, polyisobutylene, halogenated polyisoprene, halogenated polybutadiene, halogenated polyisobutylene, low-temperature epoxy, EPDM terpolymers, and combinations thereof. Add nitriles and fluoro
34. The method of claim 25, wherein the step of curing effects a crosslinking within the composite matrix.

35. The method of claim 25, wherein the step of curing comprises a curing process selected from the group consisting of thermal curing, radiative curing, chemical curing, and combinations thereof.
36. The method of claim 25, wherein the step of curing involves a curing agent.
37. The method of claim 25, wherein the step of curing involves a curing catalyst.
38. The method of claim 25, wherein the step of curing involves a curing temperature of from about 80°C to about 200°C.
39. The method of claim 25, wherein the step of curing involves a curing pressure of from about 1 Torr to about 760 Torr.
40. The method of claim 25, wherein the step of curing is carried out in an inert atmosphere.
41. A method comprising the steps of:
 - a) dispersing CNTs in a solvent to form a dispersion;
 - b) adding elastomeric precursor to the dispersion to form a mixture;
 - c) removing the solvent from the mixture to form a blend; and
 - d) curing the blend to form a CNT-elastomer composite.
42. The method of claim 41, wherein the CNTs are single-wall carbon nanotubes.

43. The method of claim 41, wherein the solvent is selected from the group consisting of ODCB, DMF, THF, and combinations thereof.
44. The method of claim 41, wherein the elastomeric precursor is selected from the group consisting of poly(dimethylsiloxane), polyisoprene, polybutadiene, polyisobutylene, halogenated polyisoprene, halogenated polybutadiene, halogenated polyisobutylene, low-temperature epoxy, EPDM terpolymers, and combinations thereof.
45. The method of claim 41, wherein the elastomeric precursor comprises functionality to enhance interaction with the CNTs.
46. The method of claim 41, wherein the solvent is removed by a method selected from the group consisting of filtration, precipitation, evaporation, and combinations thereof.
47. The method of claim 41, wherein the step of curing comprises a curing process selected from the group consisting of thermal curing, radiative curing, chemical curing, and combinations thereof.
48. The method of claim 41, wherein the step of curing involves a curing agent.
49. The method of claim 41, wherein the step of curing involves a curing catalyst.
50. The method of claim 41, wherein the step of curing involves a curing temperature of from about 80°C to about 200°C.
51. The method of claim 41, wherein the step of curing involves a curing pressure of from about 1 Torr to about 760 Torr.

52. The method of claim 41, wherein the step of curing effects a crosslinking within the composite matrix.
53. The method of claim 41, wherein the step of curing is carried out in an inert atmosphere.
54. A CNT-elastomer composite comprising functionalized CNTs in an elastomeric matrix.
55. The CNT-elastomer composite of claim 54, wherein the tensile modulus of the composite is 100-1000% greater than the native elastomer has a stain-at-break that is comparable to the native elastomer.
56. The CNT-elastomer composite of claim 55, wherein the CNT-elastomer composite has a stain-at-break that is comparable to the native elastomer.
57. The CNT-elastomer composite of claim 55, wherein the CNT-elastomer composite has a stain-at-break that is within 50% of the value of the native elastomer.
58. The CNT-elastomer composite of claim 54, wherein the CNTs are present in the composite in an amount that is from about 0.001 weight percent to about 20 weight percent.
59. The CNT-elastomer composite of claim 54, wherein the CNTs are covalently bound to the elastomeric matrix through functional groups attached to their sidewalls.

60. The CNT-elastomer composite of claim 54, wherein the CNTs are covalently bound to the elastomeric matrix through functional groups attached to their ends.
61. The CNT-elastomer composite of claim 54, wherein the CNTs are covalently bound to the elastomeric matrix through functional groups attached to their sidewalls and ends.
62. The CNT-elastomer composite of claim 54, wherein the CNTs interact with the elastomeric matrix via a mechanism selected from the group consisting of hydrogen bonding, van der Waals bonding, pi-pi interactions, dipolar interactions, acid-base interactions, and combinations thereof.
63. The CNT-elastomer composite of claim 54, wherein the elastomeric matrix is cured polymeric precursor selected from the group consisting of poly(dimethylsiloxane), polyisoprene, polybutadiene, polyisobutylene, halogenated polyisoprene, halogenated polybutadiene, halogenated polyisobutylene, low-temperature epoxy, EPDM terpolymers, and combinations thereof.
64. The CNT-elastomer composite of claim 54 further comprising at least one additional component selected from the group consisting of colorants, anti-degradation agents, plasticizers, and combinations thereof.
65. The CNT-elastomer composite of claim 54, wherein the CNTs are single-wall carbon nanotubes.
66. The CNT-elastomer composite of claim 54, wherein the CNTs are functionalized on their sidewall.

67. The CNT-elastomer composite of claim 54, wherein the CNT-elastomer composite has enhanced physical properties in addition to enhanced mechanical properties, wherein the additional enhanced properties are selected from the group consisting of electrical properties, mechanical properties, and combinations thereof.
68. The CNT-elastomer composite of claim 54, wherein the composite has a crosslink density of from about 0.01% to about 5 %.